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(54) **FISCAL PRINTER VIDEO WITH APPLICATION PROGRAM**

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(52) **U.S. Cl.** **345/629**; 345/547; 348/600
(58) **Field of Search** 345/629, 536, 345/545, 547, 213, 214, 592, 716–723; 348/150, 151, 159, 505, 510, 589, 600; 358/1.1, 1.13, 1.16, 1.18

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(57) **ABSTRACT**

The present invention discloses a method and system for controlling a system display from the processor controlling a fiscal printer. The system display is controlled by generating an overlay image in a storage device along with overlay image selector data. The overlay image selector data is used to control modifying circuits that can substitute or otherwise modify, with overlay image data, all or a portion of the system display image generated by application software. Since the fiscal printer hardware and firmware is not a part of the particular application software running on a point of sale device the control function of the fiscal printer need not require modification of application software or hardware.

17 Claims, 4 Drawing Sheets

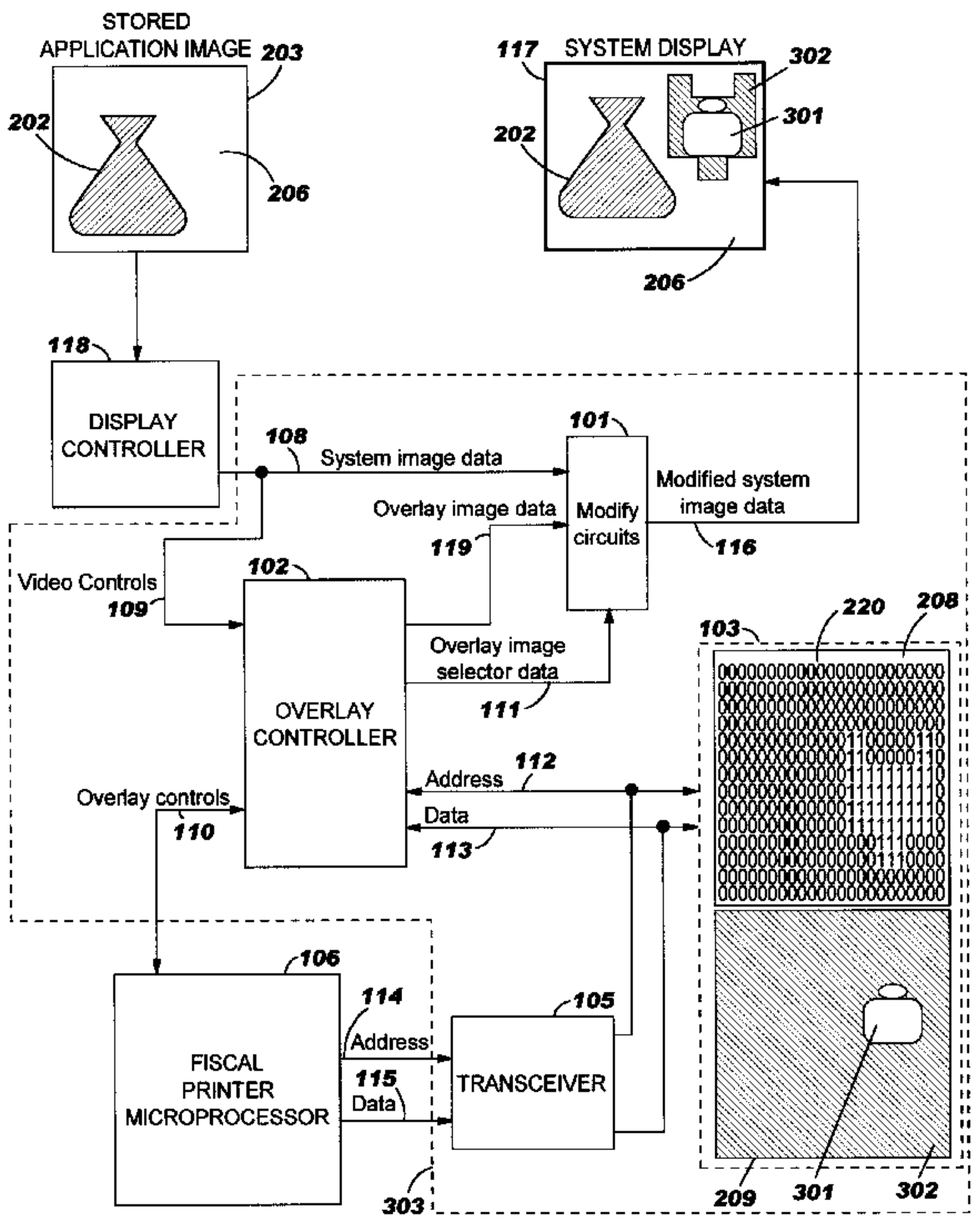


FIG. 1

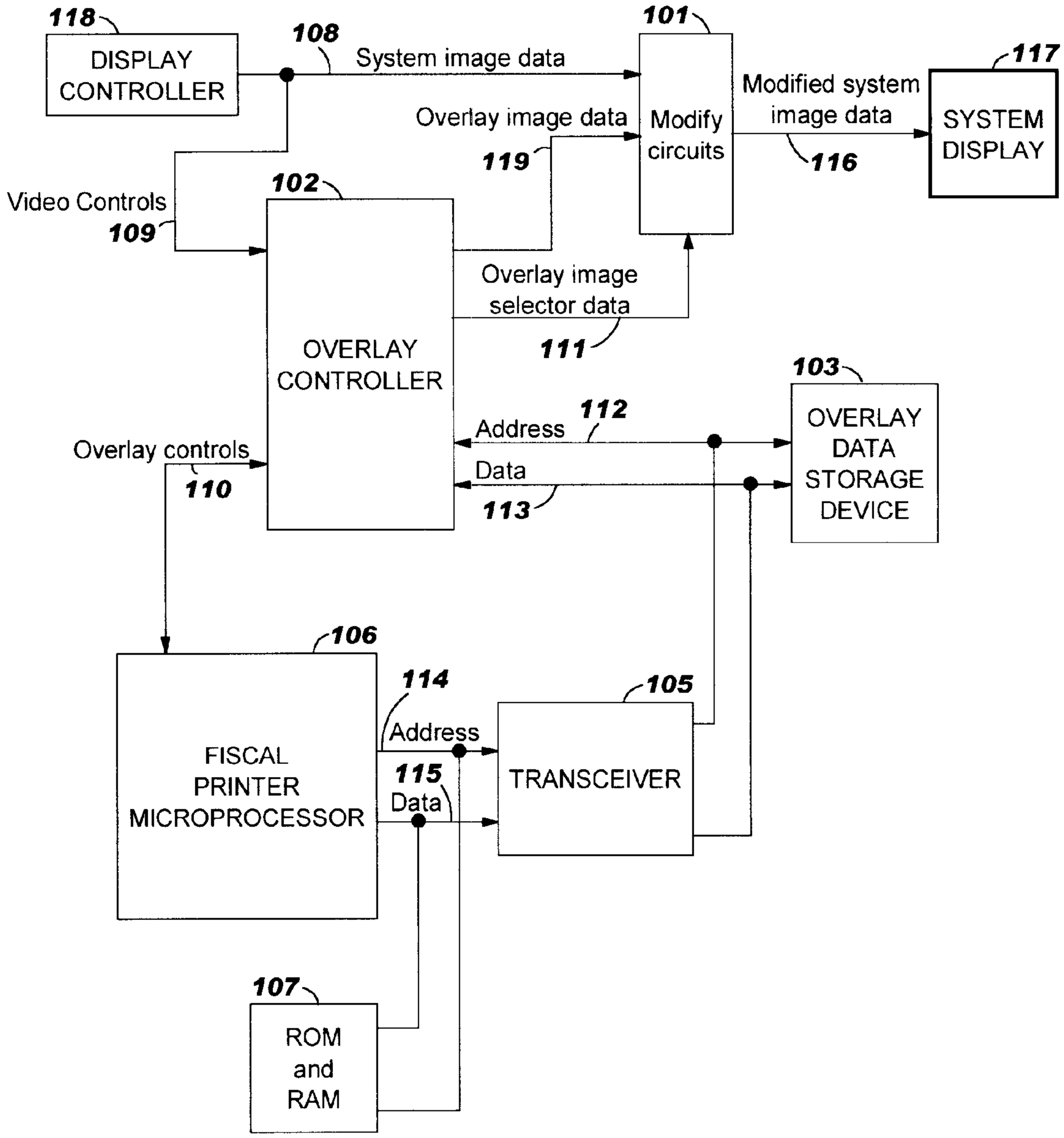

118
DISPLAY CONTROLLER
108
System image data
101
Modify circuits
Modified system image data
117
SYSTEM DISPLAY
Overlay image data
119
116
Video Controls
109
102
OVERLAY CONTROLLER
Overlay image selector data
111
103
OVERLAY DATA STORAGE DEVICE
112
Address
Overlay controls
110
Data
113
106
FISCAL PRINTER MICROPROCESSOR
114
Address
105
TRANSCEIVER
115
Data
107
ROM and RAM

FIG. 2

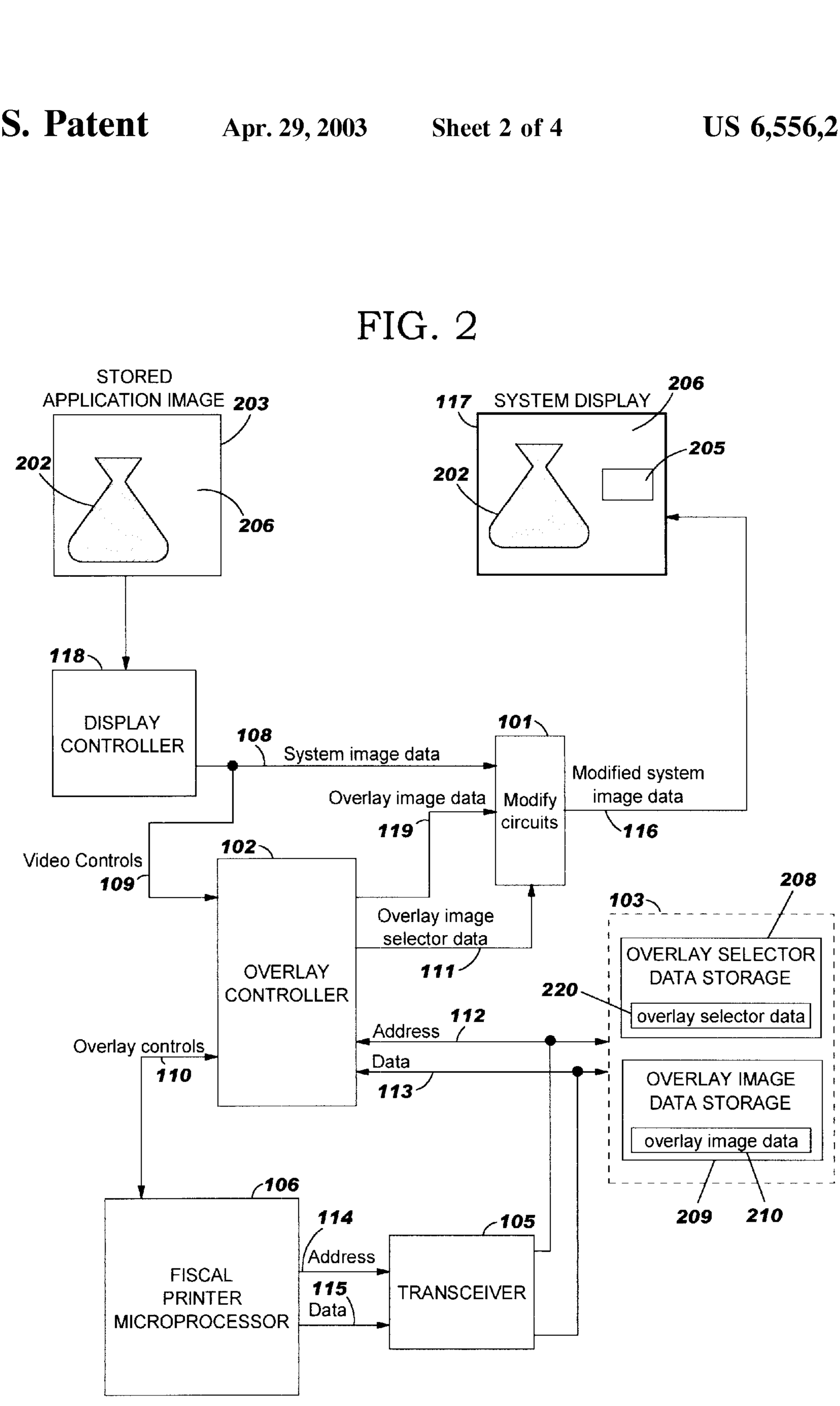
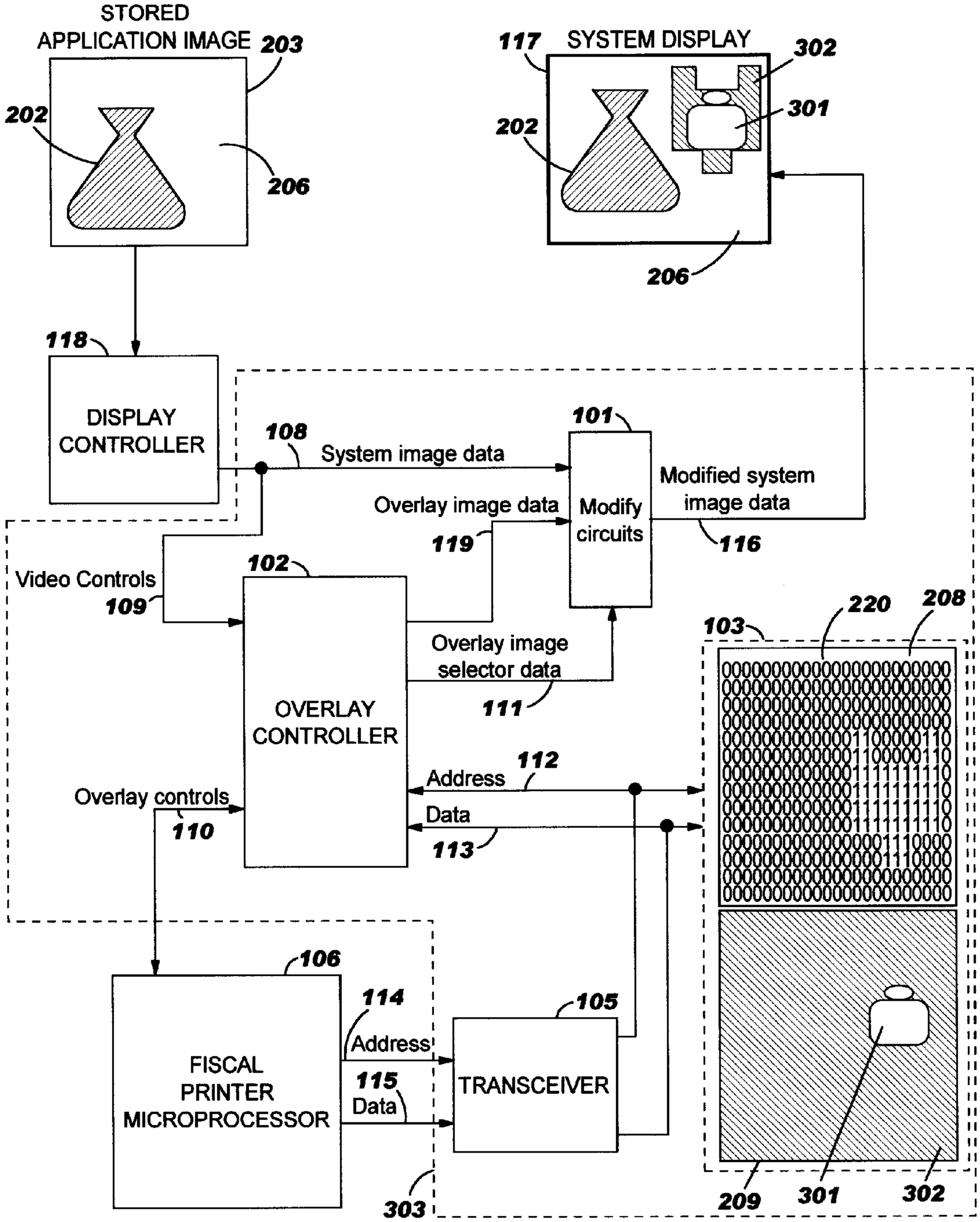

STORED APPLICATION IMAGE
203
202
206
117
SYSTEM DISPLAY
206
205
202
118
DISPLAY CONTROLLER
108
System image data
101
Modify circuits
Modified system image data
116
Overlay image data
119
Video Controls
109
102
OVERLAY CONTROLLER
Overlay image selector data
111
208
103
OVERLAY SELECTOR DATA STORAGE
220
overlay selector data
Address
112
Data
113
Overlay controls
110
OVERLAY IMAGE DATA STORAGE
overlay image data
209
210
106
FISCAL PRINTER MICROPROCESSOR
114
Address
115
Data
105
TRANSCEIVER

FIG. 3


STORED APPLICATION IMAGE
203
202
206
117
SYSTEM DISPLAY
302
301
202
206
118
DISPLAY CONTROLLER
108
System image data
101
Modified system image data
Overlay image data
Modify circuits
119
116
102
Video Controls
109
Overlay image selector data
111
OVERLAY CONTROLLER
220
208
103
112
Address
Overlay controls
110
Data
113
106
114
105
Address
FISCAL PRINTER MICROPROCESSOR
115
Data
TRANSCEIVER
303
209
301
302

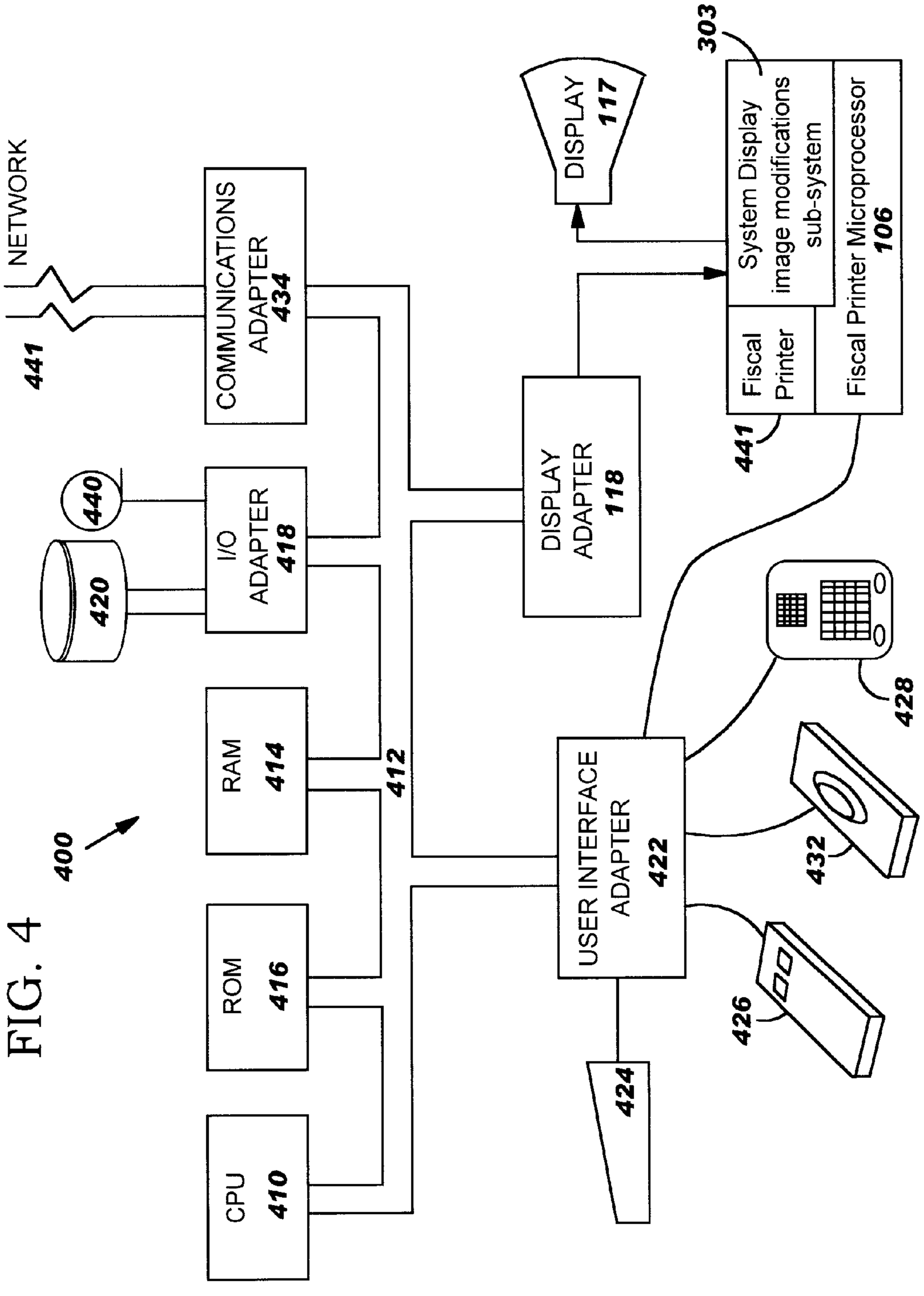

400
NETWORK
441
COMMUNICATIONS ADAPTER 434
I/O ADAPTER 418
440
420
RAM 414
ROM 416
CPU 410
412
DISPLAY ADAPTER 118
DISPLAY 117
303
System Display image modifications sub-system
Fiscal Printer
Fiscal Printer Microprocessor 106
441
428
USER INTERFACE ADAPTER 422
432
426
424

FIG. 4

FISCAL PRINTER VIDEO WITH APPLICATION PROGRAM

TECHNICAL FIELD

The present invention relates in general to data processing systems, and in particular, to displaying image data generated by a fiscal printer used in retail, point of sale operations.

BACKGROUND INFORMATION

In certain countries, point-of-sale terminal (cash register) printers must have additional hardware that collects and stores that cash register's sales totals data for reporting tax collection to the government. These printers are known as "fiscal printers". The additional hardware in the fiscal printer that collects and stores these totals is tamper-evident, which is accepted by these governments as "secure". This secure hardware controls print requests to the customer receipt print station from the terminal's application program, and it also generates printing itself, based on certain circumstances. All printing on customer receipts is also either printed on a separate "journal" paper roll, or stored electronically inside the secure hardware.

Some countries are considering requiring the fiscal printer to control the point of sale (POS) system's display. The disclosed invention allows the fiscal printer to control some or all of the video display of the POS system with an application program controlling that portion of the system display that is unused. The advent of the all digital display protocols, in particular, would allow one to easily modify the data going to an LCD display to alter a displayed image. In the event that governments require the fiscal printer to control the displayed information on a system display, a method is needed to continue to have an application program display its data while allowing the fiscal printer to modify and display additional information. The present invention discloses a method of changing the interface between a system display controller and a system display so the displayed information may be altered.

SUMMARY OF THE INVENTION

The present invention discloses a method and system for having a fiscal printer enabled to control the information displayed on a point of sale (POS) video display. The fiscal printer firmware is modified and additional circuits are added that allow the fiscal printer to load into a memory the image it wants to add to the image displayed by an application program. An overlay controller receives the video controls that provide the signals that determine the start of a scan, how many pixels are in a line and the number of lines. The fiscal printer firmware stores one or more bits of fiscal printer image data in each mapping address of possible pixels of display data. The overlay controller reads the pattern of stored data concurrent with receiving the stored application image. When stored data indicates, application image information going to the system display is modified by the corresponding data stored in the overlay memory device. Different modifications are possible, the data going to the POS display could be color modified, substituted by data stored in the overlay memory device, or changed in other ways determined by the stored data and the code in the fiscal printer microprocessor.

The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a block diagram illustrating one embodiment of the present invention;

FIG. **2** is a block diagram illustrating another embodiment of the present invention;

FIG. **3** is a block diagram illustrating another embodiment of the present invention;

FIG. **4** is a block diagram illustrating embodiments of the present invention;

DETAILED DESCRIPTION

In the following description, numerous specific details are set forth such as specific word or byte lengths, etc. to provide a thorough understanding of the present invention. However, it will be obvious to those skilled in the art that the present invention may be practiced without such specific details. In other instances, well-known circuits have been shown in block diagram form in order not to obscure the present invention in unnecessary detail. For the most part, details concerning timing considerations and the like have been omitted in as much as such details are not necessary to obtain a complete understanding of the present invention and are within the skills of persons of ordinary skill in the relevant art.

Refer now to the drawings wherein depicted elements are not necessarily shown to scale and wherein like or similar elements are designated by the same reference numeral through the several views.

FIG. **1** is a block diagram illustration of one embodiment of the present invention. System image data and control **108** from a display controller **118** is normally routed to a system display **117**. System image data and control **108** typically comprises video data for each pixel of an image and synchronizing signals that determine how a video frame is constructed for displaying the image. The number of pixels grouped together to make a complete graphic or image may be referred to as a video frame. The video frames are typically sent to a display at a frame rate that allows a viewer to see a "flicker" free image. "Pixel" is short for "picture element" and a pixel is a single point in a graphic image. Graphics monitors display pictures by dividing the display screen into thousands (or millions) of pixels, arranged in rows and columns. The pixels are so close together that they appear connected. The number of bits used to represent the video content of each pixel determines how many colors or shades of gray can be displayed. For example, in eight bit mode, the monitor uses eight bits for each pixel, making it possible to display 256 shades of gray. In a color monitor, eight bits are used for each red, green, and blue sub-pixel, making it possible to display 16.7 million colors. The video content of a pixel may be referred to as pixel video data.

In one embodiment of the present invention, a modifying circuit **101** is inserted between the display controller **118** and the system display **117**. An overlay controller **102** receives video controls **109** which are normally routed as part of system image **108** to the system display **117** for synchronizing data written to the system display **117**. The system

image data **108** may undergo delay equalization in modify circuit **101**. Other embodiments of the present invention may route the system data through the overlay controller (routing not shown) for delay equalization.

Typical synchronizing signals in video controls **109** comprise a start scan pulse that indicates when data is being transmitted for a new display frame, a sync signal with a pulse at each pixel position along a horizontal line and a horizontal line pulse indicating the start of each line of the scan. By using these signals an address can be generated for each pixel of a displayed frame of video data. A frame of video data includes data that defines pixels of the image (color or gray scale information) and where a particular pixel is located on the frame. Typically the addresses that were used to store and retrieve pixel video data of an image are lost as a video frame is generated. To synchronize a frame of video data from a display controller with a frame of overlay image data, addresses used to access pixel video data of the overlay image would need to be reconstructed from the frame data sent to a system display. Depending on the type of display used in a particular POS system, the video frame data format may be different and addressing methods may vary. For example, a Liquid Crystal Display (LCD) may have a different data format than a Cathode Ray Tube display (CRT). Other displays using light emitting diodes (LEDs), plasma, or other technologies may have consistent interface formats. All display interface methods including the all digital Transition Minimized Differential Signaling (TMDS) protocol used in transmitting images to LCDs are applicable to embodiments of the present invention.

Fiscal printer microprocessor **106** would use an addressing method to store an overlay image (not shown in FIG. **1**) in overlay storage device **103**. When a frame of video data is sent by a display controller **118**, the video control signals **109** would signal overlay controller **102** to generate synchronous addresses and read out pixel video data of an overlay image (not shown in FIG. **1**) stored in overlay storage device **103**. Each pixel of a frame of video data, from a display controller **118**, would have a corresponding pixel of overlay video data **119** retrieved from an overlay storage device **103** by overlay controller **102**. The synchronized readout of an overlay image using the video control signals **109** would allow overlay modification of frames of displayed video information. Since the pixel video data for an overlay image is synchronously retrieved using video control data **109**, offset data may be used as a method of moving an overlay image with respect to a given system displayed image. Other techniques may be used to determine when to use overlay image data to modify a video image from a display controller **118** without departing from the scope of the present invention.

The modify circuit **101** function can be controlled by overlay type selector **111** to establish such things as; the color of an overlay, if an overlay pixel is a complement of a system image pixel color, an overlay pixel background color, if overlay background is multi-colored, or if the overlay is displayed at all.

Fiscal printer microprocessor **106** stores overlay images in overlay storage device **103** using addresses **114** and data **115** via transceiver **105**, likewise, overlay controller **102** reads overlay images as data **113** using addresses **112**. Overlay controls **110** may be used by fiscal printer microprocessor **106** to communicate with overlay controller **102**. Addresses **114** and data **115** may also be used by printer microprocessor **106** to direct operations of overlay controller **102**. Read Only Memory (ROM) and Random Access Memory (RAM) **107** is memory used by microprocessor **106** and may contain data and firmware instructions.

FIG. **2** illustrates operation of one embodiment of the present invention. In the embodiment in FIG. **2** a single color shape or image **205** is an overlay to the application image **203** comprising image element **202** with background **206**. A storage device (not shown) may be used to store video pixel data describing the application image **203**. Display controller **118** would read and send the application image **203** as system image data **108** to system display **117** via modifying circuit **101**. System image data **108** would include the image data itself and any necessary video controls **109**. Modified system display data **116** is either the system image data **108** or video data modified by modify circuit **101** to include overlay image data **119**, depending on overlay selector data **111**. The data used to define the image displayed as overlay image **205** is stored in an overlay storage device **103** which contains overlay selector data storage **208** and overlay image data storage **209**. Overlay selector data **208** contains overlay selector data **220**. Overlay image data storage **209** contains overlay image data comprising an overlay image **301** and an overlay background **302** (see FIG. **3**). In the general case, overlay selector data **208** could be an array of ones and zeroes corresponding to each possible pixel indicating whether to modify the system data **108** or to pass the system image data **108** unmodified. The overlay data storage device **103** could be a memory device with a memory word comprising a bit for overlay selector data **220** and the remaining bits defining the data to be substituted for the system image data **108**.

In one embodiment of the present invention single color pixels are inserted in place of the application image **203** pixels defined by overlay selector data **220**. The overlay selector data **220**, in this example, would be simply a one or zero sent via overlay selector data link **111** by overlay controller **102** as it reads out overlay selector data storage **208**. Data representing the single color would be read from overlay image data **210** and would be sent via overlay image data link **119** to modify circuit **101** along with overlay selector data **220** indicating whether to substitute pixels of single color data for pixels of the application image. As system image data **108** is sent by display controller **118**, corresponding pixel addresses generated by overlay controller **102** are used to read out overlay selector data **220** stored in overlay selector data storage **208**. In this example, a one for example, would be stored as overlay selector data **220** in those pixel addresses where overlay image data **210** is to be substituted and a zero when system image data is to pass unmodified. Fiscal printer **106** may update the overlay selector data **220** and the overlay image data **210** by writing to overlay image storage device **103** via transceiver **105**.

In another embodiment of the present invention, modify circuit **101** may have circuitry to complement the system image data **108** at selected pixels to create a displayed overlay image. In this embodiment the overlay image data **210** is not needed, essentially eliminating the need for separate overlay image data link **119** and overlay image data storage **209**. Complementing the system image data **108** at selected pixels guarantees that a desired overlay image would not be the same color or shade as the system image. In this embodiment, other logic operations on the system image data are possible as a simple way of creating a displayed overlay image.

Other embodiments of the present invention, where it is desired to create overlay images of more than a single color, would require an increasing number of bits for the overlay image data **210**. For example, it would be possible to create

up to a four color overlay image with two bits of image overlay data **210**. A single bit of overlay selector data **220** may be used to define when to select and substitute a given image overlay data pixel color for an application image pixel.

Another embodiment of the present invention may create overlay images of more than a single color by controlling the pixel color with the overlay image selector data **220**. Multiple bits of overlay selector data **220** may be used for each application image pixel. If the overlay selector data **220** for an application image pixel was non-zero, a pixel of a preselected color may be substituted for the application image pixel. For example, it is possible to create a two or three color overlay image with two bits of overlay selector data **220** per application image pixel. In this case, separate overlay image data storage **209** units may not be needed.

In one embodiment of the present invention there would be a one to one correspondence between the addresses of the overlay data storage device **103** and the pixels of the system image data **108**. An overlay storage device **103** could, for example, store nine bits of data at each pixel address. One bit would be used for overlay selector data (substitute or not) and the remaining eight bits could be used to define up to 256 shades of gray.

FIG. **3** illustrates the embodiment of the present invention where a more complex overlay image is desired. In this example overlay image data **210** consists of an overlay image comprising an overlay image element **301** and an overlay background element **302** (cross hatched area). In FIG. **3**, they are illustrated graphically rather than using a data representation Correspondingly, an array **220** of ones and zeroes represent overlay selector data. When the overlay selector data **220** is read, zeroes represent which pixels the system image data **108** will pass unmodified and a one represents the pixel data that will be substituted for application image **203** pixel data. In this illustrative example, the pattern of ones in the overlay selector data **220** represents the parts of the overlay image element **301** and overlay background element **302** that appear on the system display **117** as image element **301** and the background segment **302**. Representing an overlay image as an image element **301** and a background element **302** is for convenience and for those cases when one wants to have the flexibility of manipulating the data representing a background separate from the data representing the shape of an image element. FIG. **3** illustrates a case where four distinct image elements, application image **202** (left hatched area), application background **206** (white), overlay image **301** (outlined shape) and its background **302** (right hatched area) are combined together using embodiments of the present invention and displayed on system display **117**. Even though background **206** may not be defined as separate data for stored application image **203**, it is separated in the illustration of FIG. **3**. Some applications manipulate an image outline and its fill color or shade separate from the fill color or shade of a background outside of outlined images. FIG. **3** illustrates in dotted line area the elements contained in system display image modification sub-system **303**.

The system display modification sub-system **303** is contained within the fiscal printer **441** shown in FIG. **4**. The fiscal printer system **441** is a secure system that has hardware and software to control information that is displayed on the system display. The fiscal printer system control is independent of any application program that is run on the system on which the fiscal printer is coupled via the system input and output (I/O) bus and display adapter. The fiscal printer is a special device that has secure hardware to insure integrity of data used to determine retail sales data. Data displayed on a fiscal printer system is also presented to customers and as such could be used in a fraudulent manner. The present invention places control of the display used to present data to customers under the control of the fiscal printer system and independent of any application program running on the system using the fiscal printer system.

Referring to FIG. **4**, an example is shown of a data processing system **400** which may be used for the invention. The system has a central processing unit (CPU) **410**, which is coupled to various other components by system bus **412**. Read-Only Memory ("ROM") **416** is coupled to the system bus **412** and includes a basic input/output system ("BIOS") that controls certain basic functions of the data processing system **400**. Random Access Memory ("RAM") **414**. I/O adapter **418**, and communications adapter **434** are also coupled to the system bus **412**. I/O adapter **418** may be a Small Computer System Interface ("SCSI") adapter that communicates with a disk storage device **420**. Communications adapter **434** interconnects bus **412** with an outside network enabling the data processing system to communicate with other such systems. Input/Output devices are also connected to system bus **412** via user interface adapter **422** and display adapter **118**. Keyboard **424**, track ball **432**, mouse **426**, speaker **428** and fiscal printer **441** are all interconnected to bus **412** via user interface adapter **422**. Display **117** is connected to system bus **412** by system image modification sub-system **303** inside fiscal printer and display adapter **118**. In this manner, a user is capable of inputting to the system through the keyboard **424**, trackball **432**, or mouse **426**, and receiving output from the system via speaker **428**, display **117**, and fiscal printer **441**.

In a retail operation environment, the data processing system of FIG. **4** may include additional devices such as a fiscal printer system **441** containing a fiscal printer microprocessor **106** and system image modification sub-system **303** including modifying circuits of the present invention. System image modification sub-system **303** would also comprise an overlay controller for retrieving, storing and sending overlay images to display **117**.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A system for controlling a display on an input and output device, comprising:

a storage device for storing overlay image data;

an overlay image controller coupled to said storage device, a display controller, and a processor controlling said device, said overlay image controller operable for receiving control signals from said display controller and generating addresses for reading out said overlay image data from said storage device;

modifying circuits coupled to said display controller, said overlay image controller and a display, said modifying circuits operable for receiving system image display data, said overlay image data, overlay image selector data and modifying said system image display data in response to said overlay image data and said overlay image selector data; and

display circuits operable for receiving said modified system image data and driving a display device for displaying a modified system image determined by said modified system image data.

2. The system of claim 1, wherein said display is a display on a point of sale cash register device.

3. The system of claim 1, wherein said modifying circuits comprises a multiplexer.

4. The system of claim 1, wherein said modifying circuit comprises logic circuits operable to perform logic operations on pixels of said system image data in response to said overlay image selector data or said overlay image data.

5. The system of claim 3, wherein said multiplexer is coupled to said display controller, said overlay image controller and said display, said multiplexer controlled by said selector data.

6. The system of claim 1 wherein said input and output device is a fiscal printer.

7. The system of claim 1, wherein said system image data and said overlay image data are digital formatted in Transition Minimized Differential Signaling (TDMS) protocol.

8. The system of claim 1, wherein said system image data is analog using a television video signal or a computer monitor Cathode Ray Tube (CRT) format and said display is an analog format display.

9. The system of claim 1, wherein said overlay image data is received from a host computer external to a host computer operating said fiscal printer.

10. A data processing system, comprising:

a central processing unit (CPU);

shared Random Access Memory (RAM);

Read Only Memory (ROM);

an I/O adapter;

a fiscal printer system;

a display adapter;

a display;

a user interface adapter; and

a bus system coupling said CPU to said ROM, said RAM, said display adapter, said I/O adapter, said user interface adapter, said fiscal printer system coupled to said user interface adapter and said display adapter; wherein said fiscal printer system further comprises:

a storage device for storing overlay image data;

an overlay image controller coupled to said storage device, a display controller, and a processor controlling said fiscal printer, said overlay image controller operable for receiving control signals from said display controller and generating addresses for reading out said overlay image data from said storage device;

modifying circuits coupled to said display controller, said overlay image controller and a display, said modifying circuits operable for receiving system image display data, said overlay image data, overlay image selector data and modifying said system image display data in response to said overlay image data and said overlay image selector data; and

display circuits operable for receiving said modified system image data and driving a display device for displaying a modified system image determined by said modified system image data.

11. The data processing system of claim 10, wherein said display is a display on a point of sale cash register device.

12. The data processing system of claim 10, wherein said modifying circuits comprises a multiplexer.

13. The data processing system of claim 10, wherein said modifying circuit comprises logic circuits operable to perform logic operations on pixels of said system image data in response to said overlay image selector data or said overlay image data.

14. The data processing system of claim 12, wherein said multiplexer is coupled to said display controller, said overlay image controller and said display, said multiplexer controlled by said overlay image selector data.

15. The data processing system of claim 10, wherein said overlay image data is received from an external host computer.

16. The data processing system of claim 10, wherein said system image data and said overlay image data are digital formatted in Transition Minimized Differential Signaling (TDMS) protocol.

17. The data processing system of claim 10, wherein said system image data is analog using a television video signal or a computer monitor Cathode Ray Tube (CRT) format and said display is an analog format display.

* * * * *